Drawings:

Applicants trust that the below amendments to the specification and the amended FIG. 1, FIG. 2 and FIG. 4 free the drawings from objection.

Specification:

The Examiner has objected to the disclosure in paragraph 3 because of the following informalities:

> On page 9, line 14, the reference "08-N" should be replaced with "208-N". On page 9, line 23 the reference numbers "208-1" to "208-N" are used in relation to data headers, but on the same page on line 14 they are used in relation to data sectors.

Applicants trust that the above amendments to the specification free the specification from objection.

The Examiner further states in paragraph 3:

> There are inconsistencies between Fig. 2 and the specification. In the figure several reference numbers have two appended numbers to them suggesting a two dimensional formatting scheme of the sectors, but in the specification on page 9 the reference numbers only have one appended numbers to them.

The Applicants believe that one appended numbers provided in the specification correspond to the two appended numbers referenced in FIG. 2 and they are obvious to one of ordinary skill in the art in light of the description provided and the two-dimensional organization of the blocks in the drawing. Therefore they are consistent with the specification. Applicant trusts that this objection will be withdrawn.

Claim Objections

Claims 7-9 were objected to because of informalities. Applicants trust that the above amendments to claims 7-9 free the claims from objection.

35 U.S.C. §102 Rejections

Claims 1-9, 12-15, 20 and 23-29 were rejected under 35 U.S.C. §102(b) as being anticipated by Duffy, U.S. Patent No. 5,640,506 (hereinafter "Duffy").

Independent Claim 1:

Duffy discloses an "improvement on the use of parity and a write cache for a RAID by adding a check code for the parity data itself" (Summary of invention, lines 24-26). Duffy discloses the addition of a parity check code that provides a check on the information in the remainder of the parity sector. In addition, an independent header for the parity sector describing its location on parity drive P and the location of the sector is provided (see col. 3, lines 66-67 and col. 4, lines 1-7). Duffy further discloses that a check code can be an exclusive OR function where the data blocks are then exclusive "OR"-ed with each other one-by-one as they are cycled through a register in the control processor.

In contrast, Applicants' claim 1 recites storing a first code into a data header that represents the user data, storing a second code in the parity header that represents parity data, and storing a third code into the header representing a value obtained by encoding the first and second codes. Applicants' claim 1 recites "the third code being used to check the consistency of user data and parity data." Accordingly, Applicants' claim 1 recites a method for checking the consistency of the user data using a code derived from both the user data and the parity data.

As the Examiner is aware, for a reference to anticipate a claim, the reference must teach every element of the claim (see M.P.E.P §2131).

Applicants respectfully submit that Duffy does not teach every element of Applicants' claim 1.

Applicants respectfully submit that Duffy is silent as to storing a first code into a data header that represents the user data, storing a second code in the parity header that represents parity data, and storing a third code into the header representing a value obtained by encoding the first and second codes where the third code is used to check the consistency of user data and parity data.

Duffy is limited to the disclosure of adding a check code for the parity data itself, providing a check on the information in the remainder of the parity sector. Duffy fails to disclose or suggest a code combining a representation of the parity data with the representation of user data. Duffy is silent on a method of checking user data and parity data by a third code.

To illustrate this difference, Applicants note that in one embodiment of the claimed invention, the first procedure first stores a respective first code into a respective data header

for each respective data sector. The first code is derived from and represents the user data stored in the data header's respective data segment. Next, the first procedure stores a second code into the parity header. The second code is derived from and represents the parity data stored in the parity sector. Finally, the first procedure puts a third code into the parity header. The third code represents a value obtained by encoding the first code and the second code. The third code is used to check the consistency of the user data and the parity data without performing respective operations on each byte of data in both the data sectors and the parity sector.

Duffy provides an improvement on the use of parity and a write cache by adding a check code for the parity data itself, which provides a check on the information in the remainder of the parity sector. In contrast, in the claimed invention a third code is used to check the consistency of the user data and parity data.

Accordingly, Applicants respectfully submit that Duffy fails to disclose all limitations of Applicants' claim 1 and the 35 U.S.C. §102(b) rejection of claim 1 as anticipated by Duffy is improper and should be withdrawn.

Claims 2 through 11:

Claims 2 through 11 are dependent from and include all limitations of claim 1. For at least these reasons, these dependent claims are further distinguished from and allowable over the disclosure of Duffy.

Claim 23:

Claim 23 includes similar language as claim 1, and thus distinguishes from Duffy for substantially the same reason. And is accordingly patentable over Duffy for the reasons described above in connection with Claim 1.

Claims 24 through 27:

Claims 24-27 are dependent from and include all limitations of claim 23. For at least these reasons, these dependent claims are further distinguished from and allowable over the disclosure of Duffy.

Claim 12:

In further contrast to Duffy, Applicants' independent claim 12 recites "a computer program mechanism comprising a data consistency checking procedure to determine

inconsistencies between *parity data* and *user data* stored in a stripe of data distributed across a plurality of data storage devices in a data storage system". The checking procedure further has a limitation of "the third code representing a value obtained by encoding the first code and the second code, the third code being used to check the consistency of the user data and the parity data without performing respective operations on each byte of data in both data sectors and parity sector" as stated in claim 12.

As stated above, for a reference to anticipate a claim, the reference must teach every element of the claim (see M.P.E.P §2131).

Applicants respectfully submit that Duffy fails to disclose or suggest "a computer program mechanism comprising a data consistency checking procedure to determine *inconsistencies* between *parity data* and *user data* stored in a stripe of data distributed across a plurality of data storage devices in a data storage system".

The Examiner suggests that Duffy teaches a first code representing each data sector, a second code for the parity data and a third code being the XOR of all the check codes stored in the parity sector. See Office Action, paragraph 14), stating:

> Referring to claim 12, Duffy discloses a program on a computer for performing a data consistency checking procedure for a system with a data distributed across data storage devices, parity data, and each sector having a header (see Fig.1 and 2, and Col. 5, line 27-65). Duffy also teaches a first code representing the each data sector storing in the sector (see Fig. 2) The data check code is stored in the same sector as the data; this is interpreted as the data check code being stored in the parity header (see Fig.2) Finally Duffy also discloses a third code being the XOR of all the check codes stored in the parity sector (see Fig. 2).

Applicants respectfully disagree with this suggestion. The Duffy reference is limited to a RAID system which includes a parity check code to provide for a check on the information in the remainder of the parity sector with a header for the parity sector describing its location on the parity drive P. The exclusive OR function mentioned in the Duffy reference is basically an exclusive OR (XOR) of each bit position in successive bytes throughout a sector (See column 1, lines 24-26) and therefore is inconsistent with the claim language reciting:

> "the third code representing a value obtained by encoding the first code and the second code, the third code being used to check the consistency of the user data and the party data without performing respective operations on each byte of data in both the data sectors and the parity sector."

As the Examiner is aware, for a reference to anticipate a claim, the reference must teach every element of the claim (see M.P.E.P §2131).

Duffy does not disclose "a computer program mechanism comprising a data consistency checking procedure to determine *inconsistencies* between *parity data* and *user data* stored in a stripe of data distributed across a plurality of data storage devices in a data storage system" as recited in part in claim 12. Rather, Duffy discloses an improvement on the use of parity and a write cache for a RAID by adding a check code for the parity data itself. Duffy further teaches that the time during which the parity check code is unprotected can be reduced by using a single loop to calculate the old parity check code and determine the new parity information itself from the new write data, and calculate the new parity check code. Thus Duffy fails to disclose reading a computer program product for use in conjunction with a processor to differentiate between corrupted parity data and corrupted user data and a method of correction of parity data or user data without performing respective operations on each byte of data in both the data sectors and the parity sector.

Accordingly, Applicants respectfully submit that Duffy fails to disclose all limitations of Applicants' claim 12 and therefore, the 35 U.S.C. §102(b) rejection of claim 12 as anticipated by Duffy is improper and should be withdrawn.

Claim 13:

Claim 13 is dependent from and includes all limitations of claim 12. For at least these reasons, this dependent claim is further distinguished from and allowable over the disclosure of Duffy.

Claims 14 and 15:

Claim 14 and 15 include similar language to the language in claim 12, and thus distinguish from Duffy for substantially the same reason stated in connection with claim 12.

Claim 28:

In further contrast to Duffy, Applicants' independent claim 28 recites:

> ...A method for checking data consistency of data stored ..... *without performing respective operations on each byte of data in both the data sectors and the parity sector*;

determining if the user data is corrupt, the determining comprising: reading the parity data and the user data; and for each respective data segment: (a) providing a calculated first code based on the user data stored in the respective data segment; (b) comparing the calculated first code to the first code to determine if the stored user data is corrupt; (c) if the user data is corrupt, regenerating the corrupt user data using certain other data sectors of the data sectors and the parity data; and, (d) storing the regenerated user data in the respective data segment, the regenerated user data replacing the corrupt user data; and

for each respective data sector: (a) if the user data in the respective data sector is corrupt, generating a new first code from the regenerated user data; and, (b) storing the new first code to the respective data sector's respective data header, the new first code replacing the first code.

As the Examiner is aware, for a reference to anticipate a claim, the reference must teach every element of the claim (see M.P.E.P §2131).

Duffy does not disclose a method for checking data consistency where a third code represents a value obtained by encoding the first and second code. In the claimed invention, the third code is used to check the consistency of the user data and the parity data without performing respective operations on each byte of data in both the data sector and the parity sector. In addition, Duffy is silent on the method of determining if the user data is corrupted and the claimed invention recites a method for this determination.

Furthermore, Claim 28 includes similar language to claim 1, and is further distinguished from and allowable over the disclosure of Duffy for the same reasons. Therefore, the 35 U.S.C. §102(b) rejection of claim 28 as anticipated by Duffy is improper and should be withdrawn.

Independent Claim 29:

Claim 29 includes similar language to claim 28, and thus distinguishes from Duffy for the same reason. Therefore, the 35 U.S.C. §102(b) rejection of claim 29 as anticipated by Duffy is improper and should be withdrawn.

35 U.S.C. §103 Rejection

Claim 10:

The Examiner has rejected Claim 10 under 35 U.S.C. §103(a) as being unpatentable over Duffy in view of Talagala et al., U.S. Patent Application Publication US 2003/0167439 (hereinafter "Talagala").

Duffy is discussed above.

Talagala is generally directed to and describes a method where vertical redundant relationships between checksums in the plurality and corresponding data blocks are reviewed. In Talagala, horizontal redundant relationship between the data block having the data integrity error and the remaining data blocks in the plurality of data blocks is also reviewed. Talagala teaches that the results of these reviews of the redundant relationships can be used to diagnose and repair the data integrity error (see page 1, paragraph 0006).

Applicants' claim 1 recites storing a first code into a data header that represents the user data, storing a second code in the parity header that represents parity data, and storing a third code into the header representing a value obtained by encoding the first and second codes. Applicants' claim 1 recites "the third code being used to check the consistency of user data and parity data". Accordingly, Applicants' claim 1 recites a method for checking the consistency of the user data using a code derived from both the user data and the parity data.

In addition, Applicants' claim 10 depends from and includes all limitations of Applicants claim 3 which states:

> The method of claim 1, further comprising:
>
> determining if the user data is corrupt, the determining comprising steps of: reading the parity data and the user data;
>
> for each respective data segment of the data segments: (a) providing a calculated first code based on the user data stored in the respective data segment; (b) comparing the calculated first code to the first code to determine if the stored user data is corrupt; (c) if the user data is corrupt, regenerating the corrupt user data using certain other data sectors of the data sectors and the parity data; and, (d) storing the regenerated user data in the respective data segment, the regenerated user data replacing the corrupt user data.

Applicants note that to establish a prima facie case of obviousness there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference teachings. Further, the

cited reference (or references when combined) must teach or suggest all the claim limitations. (See M.P.E.P. §2142).

First, Applicants respectfully submit that the Examiner has not provided a proper motivation to combine the references. The Examiner argues in paragraph 28, that it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the reporting a data loss condition disclosed by Talagala with comparison of the first codes of Duffy when they are not equal because data integrity is of the utmost importance in a RAID system. Talagala discloses the use and storage of a plurality of checksums, with each checksum having a vertical redundant relationship with a corresponding one of the plurality of data blocks. Duffy on the other hand, discloses an improvement on the use of parity by adding a check code to provide information to check on the remainder of the parity sector. Talagala is directed toward reviewing redundant relationships between checksums in data blocks. With the Duffy reference directed toward parity check code, and the Talagala reference directed toward storing a plurality of data blocks and storing a plurality of checksums, no suggestion or motivation to combine is therefore suggested. Accordingly, Applicants respectfully submits that neither reference provides a motivation to combine with the methods of the other

Further, Applicants submit that the references, even if they were to be combined, do not teach or disclose all limitations of Applicants' claims 1 and 3 from which claim 10 depends. As stated above, Applicants submit that the Duffy reference is silent as to the limitation of Applicants' claim 1 which claims a method for checking data consistency where the third code represents a value obtained by encoding the first and second codes without performing respective operations on each byte of data in both the data sector and the parity sector. Talagala discloses a reporting of data loss condition in the event when any three or more checksum contain data integrity errors and is further silent as to checking data consistency where the third represents a value obtained by encoding the first code and the second code for checking the consistency of the user data and the parity data. Accordingly, Applicants submit that the 35 U.S.C. §103(a) rejection of claim 10 over Duffy in view of Talagala is improper and should be withdrawn.

Claim 11:

Claim 11 was rejected under 35 U.S.C. §103(a) as being unpatentable over Duffy in view of Schmuck et al., U.S. Patent 5,987,477, hereinafter will be referred to as "Schmuck".

Duffy as discussed above adds a parity check code and provides for an independent header for the parity sector with a description of its location on parity drive P (see Column 3, lines 66-67).

Schmuck is directed to a computer system having a shared disk file system running on multiple computers. Schmuck discloses an improvement to achieve efficient basic file control in a shared disk environment. The shared disk file system disclosed provides "a shared disk file system where a file system on each machine has identical access to all of the disks coupled to and forming a part in the file system" (See column 3 lines 26-31). Schmuck also discloses a lock manager for determining that a lock mode does not conflict with a lock mode for another node. The lock manager contains a lock mode to prevent multiple separate peers computers nodes can access stripped files without interfering with each other Column 34 lines 4-10.

Applicants' claim 1 recites storing a first code into a data header that represents the user data, storing a second code in the parity header that represents parity data, and storing a third code into the header representing a value obtained by encoding the first and second codes. Applicants' claim 1 recites "the third code being used to check the consistency of user data and parity data". Accordingly, Applicants' claim 1 recites a method for checking the consistency of the user data using a code derived from both the user data and the parity data.

In addition, Applicants' dependent claim 11 recites:

> *The method of claim 1*, further comprising: before reading, *locking after* the step of storing and before the step of performing, by the disk array controller, the data stripe to prevent a different entity as compared to the disk array controller from performing input/output operations on the data stripe; and, after providing a data check code sub-sector, *unlocking after* performing the data stripe *to allow the different entity to perform input/output to the data stripe.*

To establish prima facie case of obviousness, there must be some suggestion and motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference teachings. Further, the reference (or references when combined) must teach or suggest all the claim limitations. (See M.P.E.P. § 2142).

Applicants submit that there is no suggestion or motivation to modify the reference teachings. The Examiner states that it would be obvious to one of ordinary skill in the art at the time of the invention to use the lock management to prevent conflicts among users disclosed in Schmuck. The Examiner points to Col. 17, lines 21-22 (see office action page 11) and suggests that Schmuck discloses a RAID system using locks and a lock management to prevent multiple separate peer computer nodes for simultaneously accessing files (See Col. 34, lines 1-9). Applicants notes that Schmuck provides a computer system having *a shared disk file system* and allows *files* to be accessed with a *file locking* mechanism while different files are cached at different nodes to ensure no file conflicts. Duffy discloses an additional parity check code in a RAID configuration for a parity data itself. Accordingly, Applicants submit that there would be no motivation to combine the teaching of Duffy with those of Schmuck as Schmuck teaches a file locking mechanism while different files are cached at different nodes to ensure no file conflict.

Further, Applicants submit that the references, taken alone or in combination, fail to disclose or suggest all limitations of Applicants' independent claim 1 from which claim 11 depends. First, neither reference teach or disclose all limitations of Applicants' claim 1 including "the third code representing a value obtained by encoding the first code and second code, third code being used to check the consistency of user data and parity data". Second, neither reference teach or disclose all limitations of Applicants' claim 11 including a solution where the data is locked for correction. Accordingly, Applicants submit that the 35 U.S.C. §103(a) rejection of dependent claim 11 is improper, and should be withdrawn.

Claims 16-19, 21 and 22:

Claims 16, 18, 21 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Duffy in view of Surugucchi et al (U.S. Patent Number 6,094,699).

In addition, claims 17 and 19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Duffy and Surugucchi in view of Johnson et al., U.S. Patent 6,219,800.

Applicants respectfully submit that the Surugucchi reference is disqualified as prior art under 35 U.S.C. §103(a). The present application and Surugucchi were, at the time the present invention was made, owned by IBM Corporation. In accordance with M.P.E.P. §706.02(l)(2)(II), enclosed is a **Statement Establishing Common Ownership**, signed by

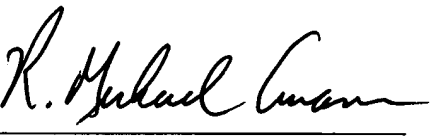
R. Michael Ananian, attorney of record in both the present application and the Surugucchi application.

Accordingly, Applicant's trust that Surugucchi is unavailable as a reference under 35 U.S.C. §103(c) and accordingly the 35 U.S.C. §103(a) rejection of claims 16, 17, 18, 19, 21 and 22 is improper, and should be withdrawn.

CONCLUSION

Applicants submit the claims are in condition for allowance, and notification of such is respectfully requested. If after review, the Examiner feels there are further unresolved issues, the Examiner is invited to call the undersigned at (415) 781-1989.

Respectfully submitted,
DORSEY & WHITNEY LLP

By 
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ANNOTATED MARKED-UP DRAWINGS

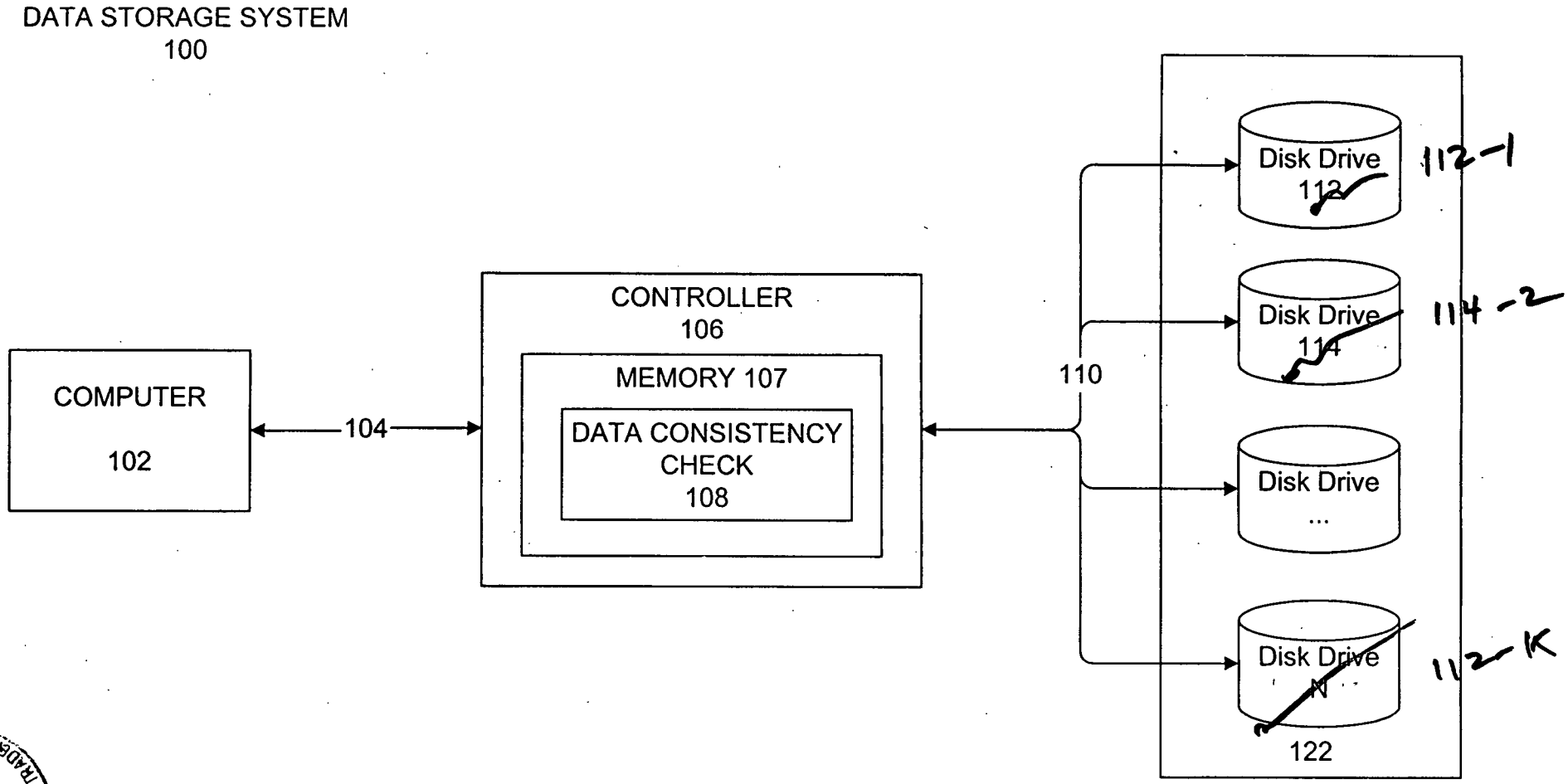

FIG. 1

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ANNOTATED MARKED-UP DRAWINGS

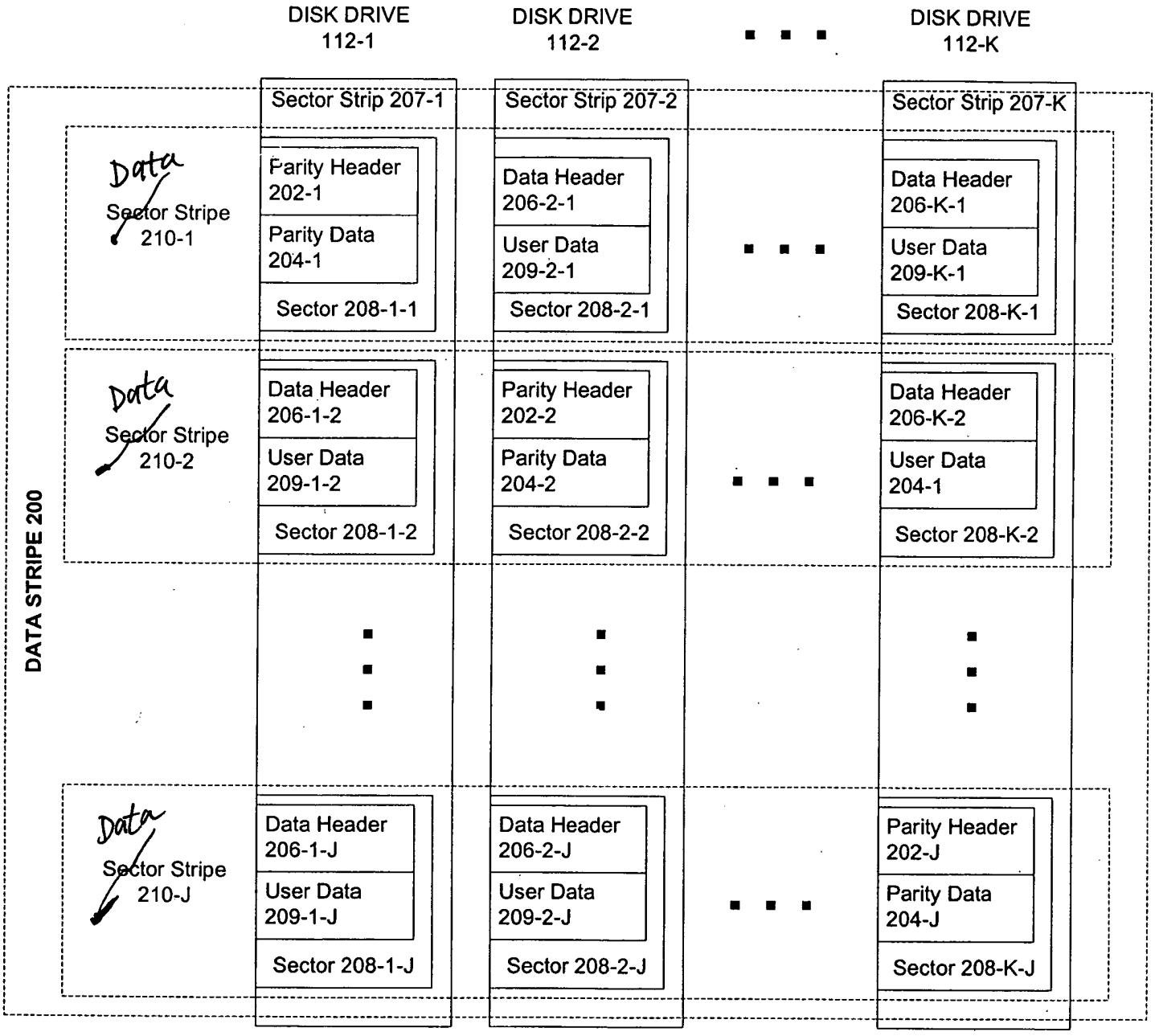

FIG. 2

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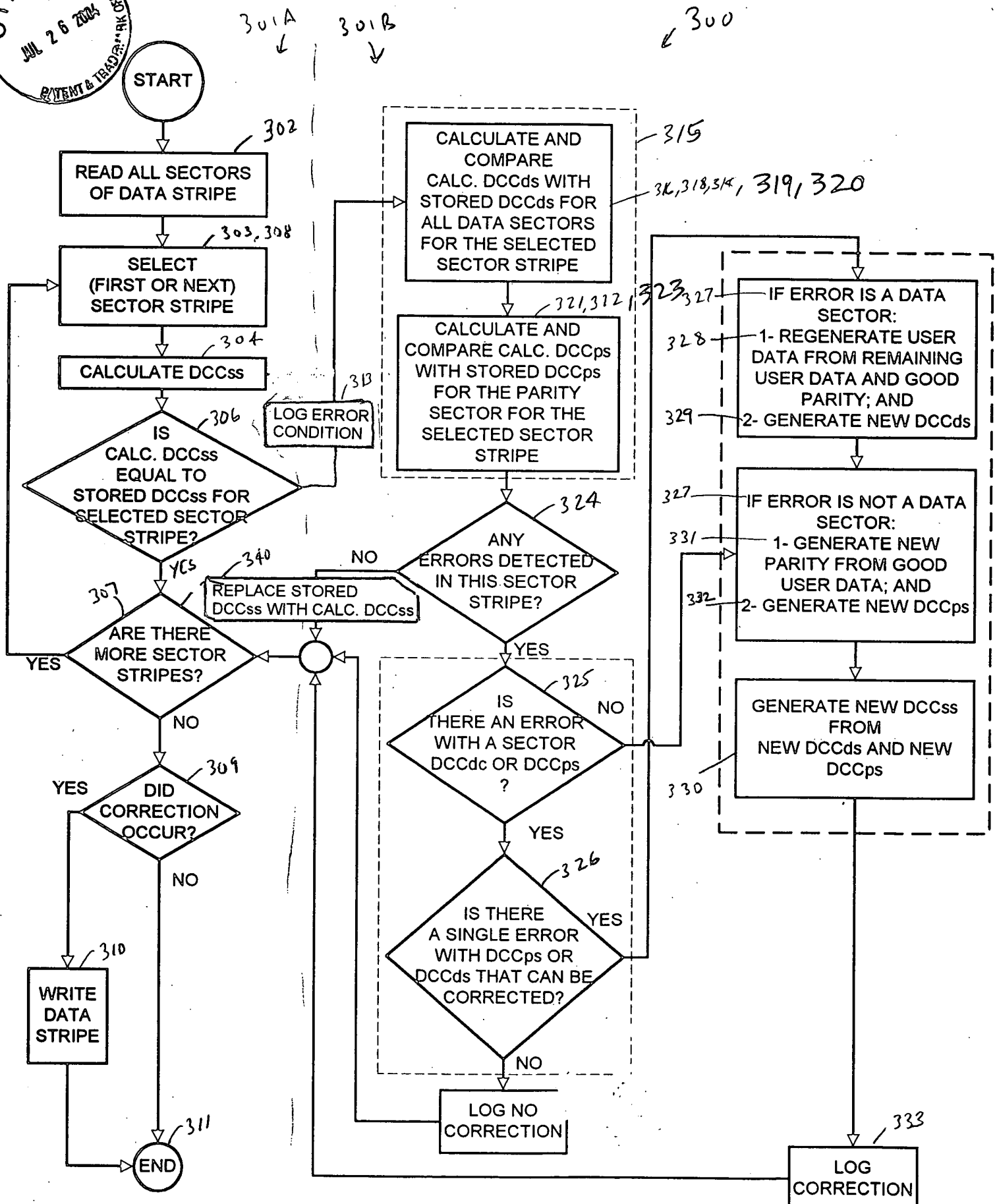

FIG. 4